THE POISONOUS SNAKE BITE PROBLEM IN FLORIDA

Henry M. Parrish, M.D., M.P.H.[1]
Ocala, Florida

Poisonous snakebites among human beings and domestic animals are by no means rare in the southern and southwestern portions of the United States. Porges (1953) estimated there were from 2,000 to 3,000 human snake bites annually in the United States. The importance of snake venom poisoning throughout the world has been studied by Swaroop and Grab (1954) who estimated there were between 30,000 and 40,000 deaths annually from this cause. Although there have been excellent epidemiological and clinical studies of poisonous snakebites by Wood (1954) in Virginia, by Swartzwelder (1950) in Louisiana, by Minton (1950) in Indiana by Shannon (1953) in Arizona, and by Andrews and Pollard (1953) in Florida, none of these studies have indicated the incidence or magnitude of the problem in a particular region.

There has been considerable research on the poisonous snakes of Florida by various biologists, herpetologists, naturalists, toxicologists, veterinarians; and physicians. Pollard (1956) asserted that venom research is a challenge to the various sciences. The intense interest in animal venoms is reflected by more than 4,100 references listed by Harmon and Pollard (1948) in their "*Bibliography of Animal Venoms*".

Incidence and Mortality

Allen and Neill (1957) collected records of 611 poisonous snakebites in Florida during the priod from 1934 through 1951—an average of 34 bites per year. The year with the largest number of bites was 1936 when 53 were reported. Andrews and Pollard (1953) estimated that there were 100 poisonous snakebites a year in Florida, or approximately between 3 and 5 per cent of all bites occurring in the United States. I (1957a) surveyed the incidence of snakebites among humans by sending a questionnaire to all of the practicing physicians and hospitals in Florida. There was an average of 120 poisonous snakebites a year in the state—an incidence of 3.36 per

[1] Research Fellow in Epidemiology and Biometry. Former Health Officer, Bureau of Preventable Diseases, Florida State Board of Health, Jacksonville, Florida.

100,000 population. An avarage fatality rate of 2.5 per cent was reported among 241 treated bites which occurred during 1954 and 1955. Poisonous snakebits have accounted for 47 deaths in Florida during the period from 1940 through 1955. Table 1 lists these deaths by year and race of the victim. Recently I (1957b) analyzed 71 snakebite deaths which occurred in the United States from 1950 through 1954 and found that 10 of them took place in Florida. Florida has an average death rate from snake venom poisoning of 0.65 per 1,000,000 population per year and ranks second to Arizona for the highest snakebite death rate in the United States. Human beings are not the only victims of envenomation. Parrish and Scatterday (1957) made a survey of bites among domestic animals in Florida for 1954 and 1955 by sending a questionnaire to the practicing veterinarians of the state. They reported 719 bites—an average of 360 bites a year among domestic animals. Dogs were the most frequent victims. There was a 26 per cent mortality among this group of treated animals.

TABLE 1

DEATHS RESULTING FROM POISONOUS SNAKEBITES IN FLORIDA, 1940-1955*

YEAR	WHITE	COLORED	TOTAL
1955	2	1	3
1954	2	1	3
1953	1	0	1
1952	2	0	2
1951	1	1	2
1950	3	0	3
1949	3	0	3
1948	5	0	5
1947	3	0	3
1946	4	0	4
1945	3	1	4
1944	3	0	3
1943	4	0	4
1942	2	0	2
1941	1	0	1
1940	4	0	4
TOTAL DEATHS	43	4	47

* From the Bureau of Vital Statistics, Florida State Board of Health, Jacksonville, Florida.

Poisonous snakebites among human beings in Florida were reported to occur more frequently than were 18 of the 38 reportable diseases listed in the Annual Report of the Florida State Board of Health (1955). There were more annual cases of snake venom poisoning reported than there were cases of the following diseases: brucellosis; diphtheria; bacillary dysentery; viral encephalitis; granuloma inguinale; leprosy; leptospirosis; lymphopathia venerum; malaria; meningococcal infections; opthalmia neonatorum; rabies; Rocky Mt. spotted fever; tetanus; trachoma; tularemia; typhoid fever; and typhus fever. In addition, a survey of practicing veterinarians showed there were more poisonous snakebites among domestic animals in Florida than there were cases of 13 of the 16 causes of animal diseases listed for the state during 1955. Thus, snake venom poisoning is a problem of considerable magnitude and importance in Florida.

Poisonous Snakes of Florida

Carr and Goin (1955) list 60 species of snakes as indigenous to Florida, of which, 7 species or sub-species are known to be poisonous. The poisonous snakes include: the eastern diamondback rattlesnake (*Crotalus adamanteus*); the canebrake rattlesnake (*Crotalus horridus atricaudatus*); the ground or pygmy rattlesnake (*Sistrurus miliarius barbouri*); the cottonmouth moccasin (*Ancistrodon piscivorus piscivorus*); the copperhead moccasin (*Ancistrodon contortrix contortrix*); and the coral snakes (*Micrurus fulvius fulvius*); and (*Micrurus fulvius barbouri*). The eastern diamondback rattlesnakes are by far the deadliest snakes found in Florida for, by virtue of their size, they produce the most venom. Approximately 85 per cent of the deaths from snakebites in Florida have resulted from rattlesnake bites. The cottonmouth moccasin is the second most deadly offender. Few deaths result from bites by pygmy rattlesnakes, copperhead moccasins and coral snakes. Indeed, only one of the 71 deaths in the United States during the period from 1950-1954 resulted from a coral snake bite. This probably resulted from the fact that coral snakes are much less aggressive than the pit vipers, they are found in a limited geographical area, and they have short fangs making it necessary for them to chew on the victim to inject venom. There are relatively few copperhead moccasin bites in Florida, since they are found only in a limited section of the northern part of the state. Of the poisonous snakebites in Florida,

rattlesnakes accounted for about 60 per cent of the bites, cottonmouth moccasins for 20 per cent, copperhead moccasins for 2 per cent, coral snakes for 2 per cent, and the species was not identified for the remainder of the bites. Of interest is an occasional cobra bite resulting from milking imported snakes whose venom is used for medical purposes.

Venoms

The venom of the pit vipers (rattlesnakes, copperheads and cottonmouth moccasins) is primarily hematoxic in action; whereas the venom of coral snakes more closely resembles that of cobras and is primarily neurotoxic in action. Kellaway (1949) has attributed the toxins in snake venoms to proteolytic enzymes, phosphatidases, and neurotoxins. The venom of pit vipers is disseminated by means of powerful "spreading factors", including hyaluronidase. Most of the venom is spread through the tissue spaces and lymphatic vessels. Phosphatidases act on the heart and circulation and also produce hemolysis of the red blood cells. Proteolytic enzymes produce local tissue damage and cause destruction of the capillary vessels. The neurotoxins poison the central nervous system and may produce motor and respiratory paralysis. Histamine is released by the body following envenomation, and it may lead to a profound drop in the patient's blood pressure. Fidler *et al.* (1940) listed the following pathological changes resulting from pit viper venoms: local destruction of the tissues and capillary endothelium; leakage of blood and serum into the tissue spaces; shock and hypotension from blood loss and histamine effects; and anemia produced by hemolysis of red blood cells. With severe venom poisoning there may be involvement of the heart, kidneys, intestines and brain. Gangrene, infection and tissue slough are important local complications. Permanent atrophy and functional disuse of an extremity or digit are by no means rare sequelae of poisonous snakebites. Parrish *et al.* (1956) found enteric and coliform organisms in the mouths and venom glands of North American pit vipers. Snake bite wounds are contaminated, venom-laden, necrotic, anaerobic, puncture wounds which provide an excellent medium for bacterial growth.

Demographical and Climatological Factors

The largest number of poisonous snakebites in Florida occurred in the heavily populated areas of the state. Figure 1 shows the

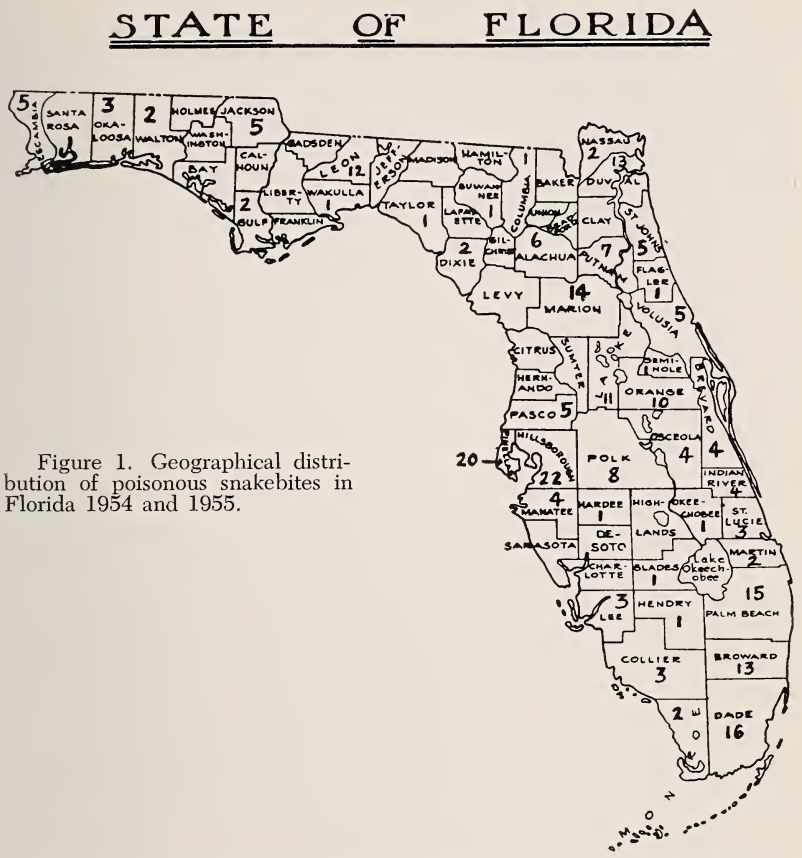

Figure 1. Geographical distribution of poisonous snakebites in Florida 1954 and 1955.

geographical distribution of bites among humans for 1954 and 1955. This geographical distribution of bites is based on the place where treatment was administered. I feel that this distribution is fairly representative of the locality where the bite occurred except in the case of bites in less populated counties where there are less adequate medical facilities. In this instance, bites are referred to hospitals in adjacent counties. The counties reporting the largest number of bites were: Hillsborough—22; Pinellas—20; Dade—16; Palm Beach—15; Marion—14; Duval—13; Broward—13; Leon—12; Lake —11; and Orange—10. With the exception of Marion, Lake and Leon counties, all of the counties with over 10 bites for the two year period had a population of over 100,000 persons. Also of interest is that poisonous snakebites occurred in all portions of the

state. These findings suggest that the number of population at risk is an important factor in the distribution of bites.

Although usually the heavily populated counties reported the most cases of envenomation, Table 2 indicates that they don't necessarily have the highest incidence rates per 100,000 population. Of the counties reporting, more than 10 bites for the two year period, the highest incidence rates were found for the following: Marion—15.55; Lake—12.21; Leon—10.0; and Palm Beach—4.77. Marion county had the highest incidence rate, but there are two contributing factors which account for this high rate: (1) approximately half of the cases were employees of Ross Allen's Reptile Institute where venom is routinely extracted for medical and research purposes; and (2) cases were referred to the Marion county hospital for treatment from adjacent smaller counties which have less adequate medical facilities.

Neill (personal communication) has found that, " . . . throughout much of Florida, the eastern diamondback rattlesnake (*Crotalus adamanteus*) is far less common in wild, remote places than in areas of rural and suburban settlement. It is most abundant in regions where scattered farms, fields and houses alternate with strips and patches of woods. This conclusion is based not only on personal experience but on the experience of hundreds of people who catch rattlesnakes for sale to the Ross Allen Reptile Institute."

Table 3 lists the number of poisonous snakebites among human beings and domestic animals in Florida by the month of occurrence. The month snakebite accidents took place among domestic animals parallels that of bites among human beings. Few bites occurred during the winter months. The number of bites gradually increased beginning in April and reached a peak during August and September. These are the periods of greatest out-of-doors exposure and recreational activity for man. Contrary to popular opinion, most snakebites among dogs do not occur during the hunting season. I can offer no theory to explain the seasonal distribution of bites among animals. Swartzwelder (1950) felt that this seasonal distribution of bites among humans possibly was due to the inactivity of snakes during the colder months as well as to mans' greater exposure during the warmer months. Neill (1955) reported that more eastern diamondback rattlesnakes are found during the winter months in Florida and that their period of greatest activity was during February. He stated that, " . . . during the hot summer

TABLE 2

INCIDENCE OF POISONOUS SNAKEBITES IN FLORIDA BY SELECTED COUNTIES

County	Estimated Pop. 1955*	No. Bites per Year	Rate per 100,000
Dade	691,244	8.0	1.16
Duval	396,502	6.5	1.64
Hillsborough	323,023	11.0	3.40
Pinellas	217,066	10.0	4.61
Orange	176,402	5.0	2.83
Broward	159,052	6.5	4.09
Escambia	157,385	2.5	1.59
Palm Beach	157,086	7.5	4.77
Polk	156,167	4.0	2.56
Leon	59,995	6.0	10.00
Lake	45,055	5.5	12.21
Marion	45,010	7.0	15.55
St. Johns	29,378	2.5	8.51
Lee	31,142	1.5	4.82
Nassau	15,131	1.0	6.61
Walton	15,116	1.0	6.62
Gulf	9,444	1.0	10.59
Okeechobee	4,188	0.5	11.94

* Annual Report, Florida State Board of Health, Jacksonville, 1955. p. 30.

TABLE 3

MONTHS POISONOUS SNAKEBITES OCCURRED AMONG HUMAN BEINGS AND DOMESTIC ANIMALS IN FLORIDA, 1954-55

Month	Number of Bites		Total
	Human beings	Domestic animals*	
January	7	6	13
February	6	4	10
March	13	16	29
April	25	31	56
May	27	43	70
June	28	48	76
July	35	44	79
August	33	54	87
September	38	65	103
October	16	34	50
November	7	18	25
December	6	9	15
Total	241	372	613

* Data on animal bites limited to 1955.

months few diamondbacks are found. Yet our figures on snakebite incidence reveal that diamondback bites reach a peak in summer, and are at a low in the winter. Clearly, then, the season incidence of diamondback bite in Florida reflects human activity; in the summer the woods and fields are visited by many people." Thus human activity as well as the habits of snakes are determinants in the seasonal incidence of bites.

Host Factors

Of 241 human victims of envenomation in Florida during 1954 and 1955, 179 were males and 62 were females. That males were more frequently bitten than females probably reflects their increased risk due to types of occupation and recreation. There were 199 bites among white persons, 41 among Negroes, and one in an Indian. This racial difference is not remarkable since there are approximately four white persons for every Negro in the state and there were five bites among whites for every bite in a Negro. Indians constitute a minority group in the state, hence the small number of bites among this group. These data may be misleading however in that this group probably does not seek medical treatment but uses tribal medicines. Forty-nine per cent (119) of the bites occurred in young people less than 20 years of age. The natural curiosity of children and their lack of knowledge about the danger of snakes probably attributed to the high incidence in this age group.

The occupation of the snakebite victims were as follows: schoolchildren—68; pre-school children—48; housewives, especially those who kept gardens or lived in rural areas—23; construction workers—12; and professional or amateur snake collectors—10. Only 7 members of the Armed Forces were bitten. These data indicate that persons engaged in out-of-doors activities have an increased risk to snake venom poisoning.

The activity of the victim at the time of a bite is obviously a more important factor than the victim's occupation. Although the activity of the patient at the time of the envenomation was not stated in 82 instances, it is of significance that 43 children were bitten while playing in the yard or in close proximity to their places of residence. Many of these bites might have been prevented if they had been wearing shoes and long trousers. Twenty-three persons were bitten

while handling a poisonous snake. One of the easiest ways to be snakebitten is for an inexperienced (or oftentimes experienced) person to pick up a poisonous snake. Of the persons reported bitten while engaged in recreation, 17 were fishing, 2 were swimming and 2 were hunting. These facts may come as a surprise to many hunters.

TABLE 4

ANATOMICAL LOCATION OF POISONOUS SNAKEBITES AMONG HUMANS AND DOMESTIC ANIMALS IN FLORIDA 1954 AND 1955

SITE OF BITE	HUMAN No. Bites	%	DOMESTIC ANIMALS No. Bites	%
Head and Face	1	0.4	291	40.5
Arm or foreleg	16	6.6	111	15.4
Shoulder	2	0.8	72	10.0
Neck	0	—	50	6.9
Leg or hindleg	60	25.0	43	6.0
Chest	0	—	38	5.4
Fingers, hand or forepaw	89	36.9	13	1.8
Toes, foot or hindpaw	53	21.9	13	1.8
Abdomen	0	—	15	2.0
Tail	0	—	4	0.6
Buttock	1	0.4	—	—
Not Stated	19	8.0	69	9.6
Total	241	100.0	719	100.0

There are distinct differences between snakebites among human beings and snakebites among domestic animals. One of the more notable differences is the anatomical site of the bite. Table 4 lists the anatomical location of poisonous snakebites among humans and domestic animals. In contrast to humans in whom more than 90 per cent of snakebites occur on the extremities, domestic animals are more frequently bitten on the head, shoulder and neck. In general, bites on the face or trunk are more serious since the venom is more rapidly absorbed into the general circulation and these sites do not lend themselves readily to the use of a tourniquet and surgical therapy. Other factors which tend to make snake venom poisoning more serious in animals are the delay in treatment after the bite and the small size of the animals which increases the ratio of the units of venom injected to the units of body weight.

Diagnosis

Frequently a patient will bring the offending reptile to the physician when reporting for treatment. Pit vipers may be identified by a deep pit which is located between the eye and nostril. The pupil of all pit vipers is elliptical in shape, in contrast to the round pupil of non-poisonous snakes. They have two well developed fangs located on the upper jaw. In addition, the rattlesnakes are recognized by rattles which are attached to the tail. The other pit vipers do not have rattles. (See Figure 2 which demonstrates the diagnostic features of pit vipers.)

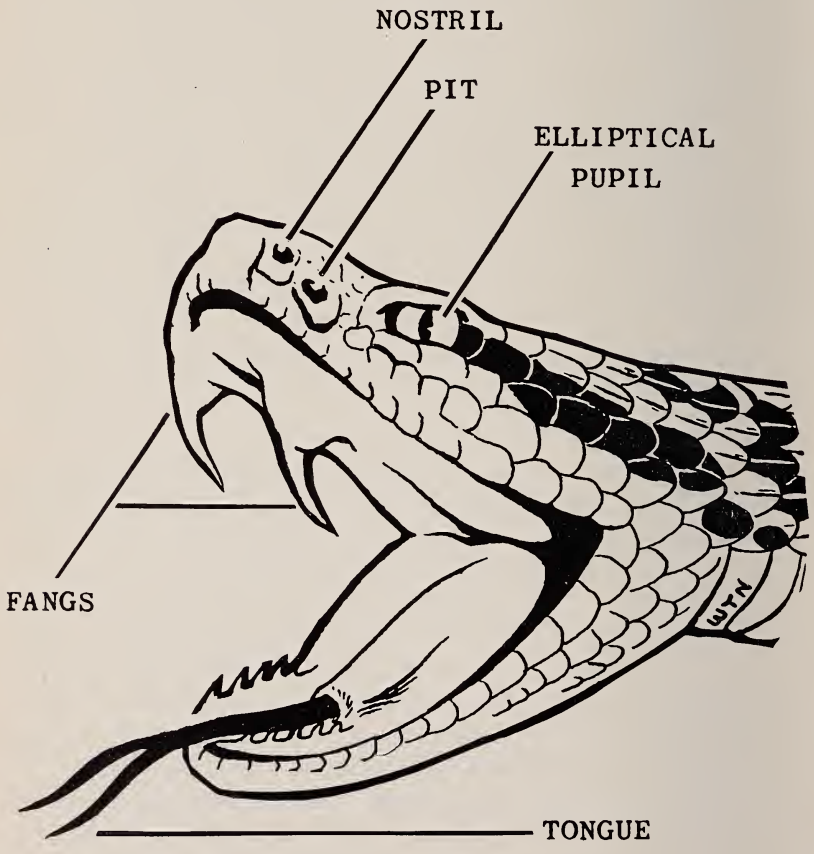

Figure 2. Head of a pit viper, showing diagnostic features.

Coral snakes are brilliantly colored snakes, rarely over three feet in length, which have broad rings of scarlet and black separated by narrow rings of yellow. An important fact to remember is that the snout is always black. To remember the phrase "red next to yellow will kill a feller" is also helpful in identifying them, since several non-poisonous snakes closely resemble the coral snakes.

Pit vipers account for 96 to 98 per cent of all poisonous snakebites in Florida; therefore, I will confine my remarks to this group of snakes. Since pit vipers possess two well developed fangs, a pit viper wound usually has one or two (occasionally three or four, if new fangs are growing in to replace old ones) puncture wounds which are surrounded by an area of redness and swelling. If the fangs glanced off the bitten area, only a scratch will be seen. In this case, there will be less surrounding erythema and swelling. An important fact worth remembering is that a poisonous snake may bite a person without injecting enough venom to produce clinical signs and symptoms of envenomation. If the bite was a serious one the swelling will progress rapidly. Pope and Perkins (1944) experimentally differentiated the bite patterns of poisonous snakes from those of non-poisonous snakes. They noted that poisonous snakes' bites may leave teeth impressions in addition to those made by the fangs. However, non-poisonous snakes' bites never leave large fang puncture wounds. Also, practically no swelling results from the bite of a non-poisonous snake. If in doubt about the diagnosis of a poisonous snakebite, it is better to observe the bite site for a period of time rather than to vigorously treat a patient for a bite which later proves to be of non-poisonous origin. Watt and Pollard (1954), Watt, Parrish and Pollard (1956) and Andrews and Pollard (1953) have carefully described the signs and symptoms resulting from bites by the venomous snakes of Florida. I have noticed that local pain at the injection site is a symptom of pit viper poisoning and occurs in about 80 to 90 per cent of the cases. The pain is usually intense and burning in character. However, occasional severe bites may not prove painful for the neurotoxic fraction of the venom produces numbness and tingling which alters the pain response. This is especially true of severe bites by the eastern diamondback rattlesnake. Other symptoms which may be present are: shock; weakness; nausea; vomiting; numbness, especially in the extremities and circumoral areas; difficulty in breathing; muscular twitching and motor paralysis. (Refer to Table

5 for the differential diagnosis between poisonous and non-poisonous snakebites.)

TABLE 5

DIFFERENTIAL DIAGNOSIS OF POISONOUS AND NON-POISONOUS SNAKEBITES

Characteristic	Poisonous	Non-poisonous
Fang puncture	Present	absent
Tooth marks other than fangs	may be present	present
Pain	usually intense	minimal
Swelling or edema surrounding bite site	extensive and progressive	none to very minimal
Erythema surrounding bite site	extensive and progressive	none to minimal
Shock	may be present	absent
Nausea and vomiting	may be present	absent
Muscular twitching	may be present	absent
Coma	may be present	absent
Motor or respiratory paralysis	may be present	absent
Numbness and parasthesias	may be present	absent
SEQUELAE infection	common	rare
gangrene	common	none
sloughing	common	none
atrophy	common	none
anemia	common	none

Some of the factors which determine the severity of a poisonous snakebite are: the age, weight and general condition of the patient; how soon treatment is instituted after a bite; the location of the bite; the nature of the bite (a glancing scratch as opposed to deep impregnation of the venom); and the toxicity of the venom of the specific snake. In general, the amount of venom a snake produces is in direct proportion to its size; however, the venom of small and young snakes is just as toxic as that of larger snakes. Bites on the face and trunk are more dangerous than bites on the extremities. Also, envenomation is always more serious in small children as the ratio of the units of venom injected to the units of body weight is much greater. Poisonous snake bites are poorly tolerated by older individuals who have other physical ailments and less general resistance.

Wood, Hoback and Green (1955) have devised an excellent clinical classification of the severity of pit viper envenomation based on the signs and symptoms and the patient's course during the first 12 hours of hospitalization. They classify bites as *Grade I*—

Minimal Venenation if there is evidence of a fang wound with surrounding swelling not extending for more than a few inches, and without the presence of systemic symptoms. *Grade II—Moderate Venenation* includes those cases with the signs of Grade I but with progressive swelling which involves about half the distance between the bite site and the trunk. Nausea, vomiting and giddiness are usually present as are palpable regional lymph nodes and a low grade fever for several days. *Grade III—Severe Venenation* includes patients whose early course may resemble those of Grade I and II but the intoxication progresses rapidly. The patients may experience hypotension and shock within a few minutes following the bite. The swelling is more extensive and in 12 hours advances to or involves part of the trunk. The pulse is often rapid and thready and the temperature is subnormal. Petechiae are frequently generalized in distribution. In addition, I have observed that these patients frequently are comatose and have either localized or generalized muscular twitching. Perhaps a *Grade O—Poisonous Snakebite Without Venenation* should be added to include those patients either bitten or scratched by poisonous snakes' fangs but who do not exhibit local swelling and pain or other signs and symptoms of clinical venenation. Parrish and Pollard (1957) classified 60 poisonous snakebites occurring among 12 individuals with repeated poisonous snakebites and found that of 15 instances of Grade III—severe venenation, 9 were caused by rattlesnakes (*Crotalus sp.*) 4 were caused by cottonmouth moccasins, and 2 were produced by copperhead moccasins. Thus, pygmy rattlesnakes and copperhead moccasins rarely produce severe venenation.

Treatment

The treatment of snake venom poisoning may be divided into two phases: (1) first aid treatment; and (2) hospital treatment. The rationale for treatment is based on the following measures:

First Aid

A. Prevent or retard venom absorption locally
B. Remove the venom locally

Hospital Treatment

A. Neutralize the venom locally
B. Neutralize the venom systemically

C. Increase elimination of the venom systemically (theoretical)

D. Prevent local complications

E. Prevent systemic complications

First Aid Treatment—Before administering first aid treatment these questions should be answered: Has this patient been snakebitten, and, if so, was it by a poisonous snake? Is there a break in the skin or fang marks in the bitten area? Does the patient complain of pain, and is there evidence of local swelling and redness? *Do not make the mistake of applying drastic first aid measures to a patient who shows no objective evidence of venom poisoning.*

A. The presently accepted first aid treatment includes immediate application of a *constricting band* several inches above the bite site. The term "tourniquet" has been purposely avoided because the constricting band should be applied only tight enough to occlude the *superficial* venous and lymphatic circulation. A word of caution —do not apply the band tight enough to occlude the arterial blood flow, and be sure to release the band every 10 to 15 minutes for a period of 2 or 3 minutes. Advance the band up the extremity as the swelling progresses so as to keep just ahead of the swelling. Intermittent use of a constricting band should be continued until the patient is seen by a physician. The purpose of the constricting band is to impede the spread of venom until it can be mechanically removed or neutralized. Pope and Peterson (1946) have shown that animals treated with a tourniquet alone survive longer than those with no treatment.

B. In addition to a constricting band, small superficial cruciate *incisions* should be made over the fang marks; they should be about ¼ of an inch long and ⅛ to ¼ of an inch deep (just deep enough to draw blood). Do not mutilate a patient with deep stab wounds. Often the results of drastic first aid treatment prove to be worse than the snakebite. Additional incisions may be spaced two or three inches apart as the venom spreads. Very little pain results from these incisions owing to the numbing effects of the venom. If the incisions are properly made there is practically no danger of injuring a major blood vessel or nerve. *Suction* should be applied to the incisions to remove the venom. Suction cups provided with Cutter or Becton-Dickinson snakebite kits are adequate for this

purpose. If suction cups are not available, oral suction may be used. There is very little chance of becoming intoxicated from swallowing venom, as it is inactivated in the gastro-intestinal tract. To prove this, Allen (1949) swallowed 4 cc. of cottonmouth moccasin venom, and experienced no unusually toxic effects. However, oral suction should not be used in the presence of extensive ulcerations of the mouth. Suction should be applied for several hours depending on the seriousness of the bite. This treatment, consisting of a constricting band with incision and suction, is known as the "Jackson first aid treatment of snakebite". Jackson (1928, 1929) demonstrated survival of dogs poisoned with 4 MLD's (minimum lethal dose) of venom when treated in this manner. He showed that the bloody fluid obtained from suction cups when injected into normal dogs contained enough venom and toxic products to kill the animals.

The victim should be constantly reassured because the emotional shock and fear accompanying snakebite are often out of proportion to the severity of the bite. Do not get excited yourself for most patients who die from envenomation do so from 12 to 48 hours after the bite. With immediate first aid and proper medical treatment the mortality from venom poisoning should be less than two per cent. Keep the patient quiet, do not give him stimulants or alcohol and get him to a hospital or physician as soon as possible. The sooner a patient receives medical treatment, the better his chances are for survival.

Hospital Treatment—When the patient arrives at the hospital, the physician may want to make additional incisions for suction depending on the severity of the bite. Suction should be maintained constantly for about 2 hours. If the bite was Grade II or Grade III venenation, suction should be maintained intermittently for 2 to 6 hours. The suction cups are alternated: 15 minutes on, then 15 minutes off as long as desired. During the interim the wounds should be covered with warm saline or magnesium sulfate compresses. The constricting band should not be used after the swelling has spread up an extremity to the trunk. This usually takes two or three hours. Parrish and Gardner (1956) have discussed the nursing care of snakebite patients in detail, including the use of suction cups.

A. Although many drugs and chemicals have been tested for treating snake venom poisoning, none of them has been shown to

be of specific value. Proper snakebite treatment utilizes a combination of medical and surgical measures. The following drugs are important adjuvant remedies. Epinephrine hydrochloride, 3 to 5 minims of a 1:1000 solution, is of value in combating the shock and hypotension which invariably follow severe bites. Intravenous whole blood, saline and plasma are also useful for this purpose. Calcium gluconate solution may help prevent hemolysis produced by pit viper venom. Demerol, 75 to 100 mg., may be given to alleviate pain which is often intense.

B. Watt, Parrish and Pollard (1956) recommend "the 3 A's" (antivenin, antibiotics, and antitoxin), in addition to a constricting band with incision and suction, for treating all serious snakebites. A new, potent antivenin (Antivenin Crotalidae Polyvalent; Wyeth) has been developed which offers protection against the venom of all North American poisonous snakes except the coral snake. The manufacturers recommend one to five amopules (10 to 50 cc.) depending on the severity of the venenation. Ten to twenty cc. may be injected around the bite site and the remainder is injected into the muscles of the involved extremity. However, antivenin should not be injected into a finger or toe, as the additional fluid may embarrass the already impaired circulation and produce gangrene. Personally, I do not feel that cases of Grade I—Minimal Venenation need antivenin; however, it should be administered to patients with Grade II and Grade III Venenation. All patients should be skin-tested for sensitivity to horse serum before antivenin is given, since antivenin is made by hyperimmunizing horses with snake venoms. Pathogenic bacteria, including tetanus and gas gangrene organisms, have isolated in snakes' venom and mouths, therefore tetanus antitoxin or toxoid and gas gangrene antitoxin should be given to the patient. In addition, a wide spectrum antibiotic should be given to prevent bacterial infections. Penicillin alone is of little value because of the predominance of gram negative bacteria.

C. There has been a recent tendency in medical and veterinary practice to rely on ACTH, cortisone and antihistamine drugs as the primary treatment of snake venom poisoning; however, Schottler (1954) did not find any of them of specific value experimentally. Cortisone does not seem to prevent death from envenomation, but it does diminish the pain accompanying severe venenation and it may prevent or lessen any allergic reactions produced by horse

serum from antivenin. A word of caution about the popular "L-C Method" (ligature and cryotherapy) of treating snakebites as advocated by Stahnke (1953). This method involves the use of a tight ligature, ethyl chloride and ice packs. While theoretically freezing the tissues should lessen the enzymatic activity of venom and retard its spread, it has not been proved a reliable form of treatment. Allen (1939) found that as soon as the ice is removed the venom spreads into the body and the frozen area is subject to necrotic degeneration and sloughing. Until there is better evidence that cryotherapy is of some value and that it is not harmful, I feel it should be rejected in toto.

Summary

1. Poisonous snakebites are an important medical problem in Florida since this state ranks second to Arizona for the highest annual snakebite death rate. From 1940 to 1955 there were 47 deaths from snake venom poisoning in the state. An average of 120 human beings and 360 domestic animals are snakebitten each year in Florida. Two and one half per cent of the human cases and 26 per cent of the domestic animal cases terminate fatally.

2. Although the heavily populated areas of the state have the largest number of snakebites annually, the incidence of bites per 100,000 population is highest in Marion, Lake, Leon and Palm Beach counties. Most of the bites occur during the warmer months beginning in April and reaching a peak during August and September.

3. Males are the victims of snakebite accidents approximately three times more often than females. Forty-nine per cent of the bites occurred among young people less than 20 years of age. Persons working in out-of-doors occupations have a greater chance of being bitten. Human beings are more frequently bitten on an extremity; whereas domestic animals are more often bitten on the head, neck and shoulders.

4. At least one species of each of the four kinds of poisonous snakes found in the United States is known to inhabit Florida; they are the rattlesnake, the copperhead moccasin, the cottonmouth moccasin, and the coral snake. Rattlesnakes accounted for 60 per cent of all bites, and most of the snakebite deaths. Methods of distinguishing between poisonous and non-poisonous snakes is given in detail.

5. The first aid and medical treatment of snakebites is discussed and "the 3 A's" (antivenin, antibiotics and antitoxin), in addition to a constricting band with incision and suction, are recommended for treating snake venom poisoning.

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